Technology Use in the Classroom with References

Technology is a vital tool for teaching and learning mathematics.

- Strategic instructional use of technology enables teachers to strengthen students' conceptual understanding, problem solving skills, and disposition toward mathematics.

- While students are exploring patterns, conducting investigations, testing conjectures, and solving problems, they should have full access to calculators as well as other appropriate instructional technology; however, if the primary purpose of the instructional activity is developing students' computational skills, then calculators should not be used.

- Calculators are an integral part of instruction and assessment. The use of calculators on assessments should be determined by the content/learning targets being measured. If the intent of the assessment is to measure

    - computational skills or fluency then calculators should not be used,
    - graphing skills then graphing calculators should not be used and
    - algebraic skills then algebraic applications or computer algebra systems should not be used.

References regarding technology use in the classroom:

Bay-Williams, J. M., Van de Walle, J. A., & Karp, K. S. (2013). *Elementary and middle school mathematics: Teaching developmentally* (8th ed.). p. 116.

- "Based on efficiency and effectiveness, the student should learn when to use mental mathematics, when to use estimation, when to tackle a problem with paper and pencil, and when to use a calculator."
- "If the primary purpose of the instructional activity is to practice computational skills, students should not be using a calculator. On the other hand student should have full access to calculators when they are exploring pattern, conducting investigations, testing conjectures, solving problems and visualizing solutions. Situations involving computations that are beyond students' ability without the aid of a calculator are not necessarily beyond their ability to think about meaningfully.

Kilpatrick, J. (2003). *Adding + it up: Helping children learn mathematics*. p. 427. Downloaded from the National Academies Press, *Adding + it up*.

- "Just like any instructional tool, calculators and computers can be used more or less effectively. Our concern is that, when computing technology is used, it needs to contribute positively:

- In all grades in elementary and middle school any use of calculators and computers should be done in ways that help develop all strands of students' mathematical proficiency".

National Council of Teachers of Mathematics. (2000). Principles for school mathematics: The technology principle. In *Final report of the coordinating review committee for the National Council of Teachers of Mathematics: Principles and standards for school mathematics* (pp. 24 - 27). Reston, VA: Author.

National Council of Teachers of Mathematics (2015) Position statement on calculator use in elementary grades. Reston, VA: Author.
NCTM 2015 position: Calculators in the elementary grades

- "Calculators in the elementary grades serve as aids in advancing student understanding without replacing the need for other calculation methods. Calculator use can promote the higher-order thinking and reasoning needed for problem solving in our information- and technology-based society. Their use can also assist teachers and students in increasing student understanding of and fluency with arithmetic operations, algorithms, and numerical relationships and enhancing student motivation. Strategic calculator use can aid students in recognizing and extending numeric, algebraic, and geometric patterns and relationships."

National Council of Teachers of Mathematics (2011). Position statement on the strategic use of technology in teaching and learning mathematics. Reston, VA: Author.
NCTM 2011 position: Strategic use of Technology in Teaching and Learning Mathematics

- "It is essential that teachers and students have regular access to technologies that support and advance mathematical sense making, reasoning, problem solving, and communication. Effective teachers optimize the potential of technology to develop students' understanding, stimulate their interest, and increase their proficiency in mathematics. When teachers use technology strategically, they can provide greater access to mathematics for all students."

National Council of Teachers of Mathematics. (2014). Tools and technology. In *Principles to actions: Ensuring mathematical success for all* (pp. 78 - 88). Reston, VA: Author.

- "Moreover, students may reflexively apply a favored too (physical or virtual) without thinking about, or having a teacher challenge them to think about, its appropriateness or whether another approach might be more fruitful. These unproductive uses of tools and technology limit students' opportunities to reason with and about mathematics and demonstrate the importance of the role of teachers who have a deep knowledge of mathematics and understand how such tools and technology can be used strategically in ways that support meaningful learning."

Kentucky Department of Education High Quality Teaching and Learning – excerpts referencing technology.

Instructional Relevance

Teacher Characteristics:

- Teacher selects and utilizes a variety of technology that support student learning.
- Teacher effectively incorporates 21st Century Learning Skills that prepare students to meet future challenges.

Student Characteristics:

- Student communicates knowledge and understanding in a variety of real-world forms. The student:
  1) draws from prior learning knowledge to learn new mathematics content.
  2) utilizes 21st Century Learning Skills to prepare to meet future challenges.

Instructional Rigor and Student Engagement

Teacher Characteristics:

- Teacher integrates a variety of learning resources with classroom instruction to increase learning options. The teacher:
  1) models and integrates a variety of learning resources (technology including computers, software, calculators, manipulatives, diagrams) in classroom instruction for the purpose of understanding and solving mathematics problems and communicating their solutions.

Student Characteristics:

- Student applies and refines inquiry skills. The student:
  1) asks questions and identifies concepts to guide problem solving
  2) uses appropriate tools (technology and manipulatives) to facilitate mathematical reasoning.